(12) UK Patent Application (19) GB (11) 2 189 110 (13) A

(43) Application published 14 Oct 1987

(21) Application No 8606552

(22) Date of filing 17 Mar 1986

(51) INT CL⁴
H04R 1/44

(52) Domestic classification (Edition I)
H4J 30N 30X 31P DQ

(56) Documents cited
GB 1454844

(58) Field of search
H4J
Selected US specifications from IPC sub-class H04R

(71) Applicant:
The Plessey Company plc.

(Incorporated in United Kingdom)

Vicarage Lane, Ilford, Essex

(72) Inventor:
John Philip Dakin

(74) Agent and/or Address for Service
K. J. Thorne, The Plessey Company plc, Intellectual Property Department, Vicarage Lane, Ilford, Essex

(54) Optical fibre hydrophone

(57) An optical fibre hydrophone comprises a coiled optical fibre 1 and a cylindrical former 2 which supports the optical fibre and which has an internal or external radial flange 3 located centrally therealong for mounting the hydrophone.

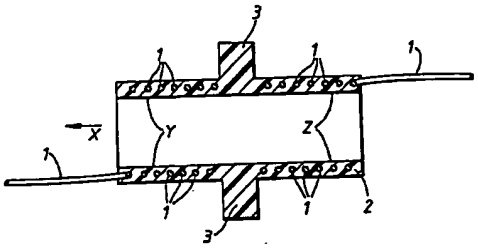

FIG.2.

GB 2 189 110 A

1/2

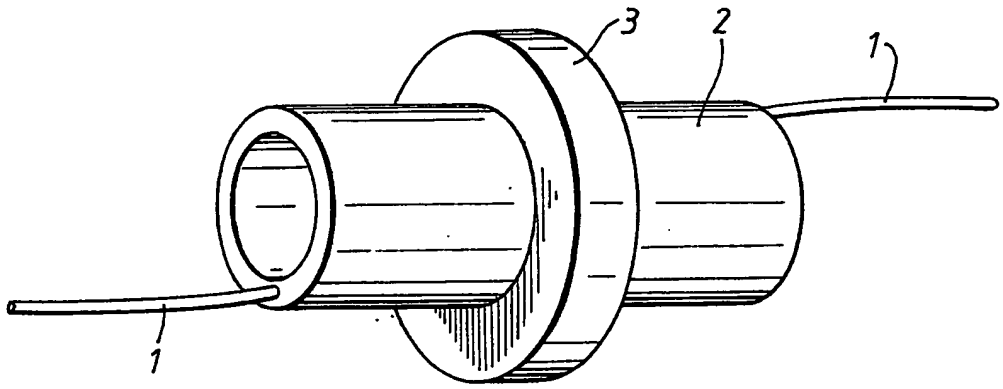

FIG.1.

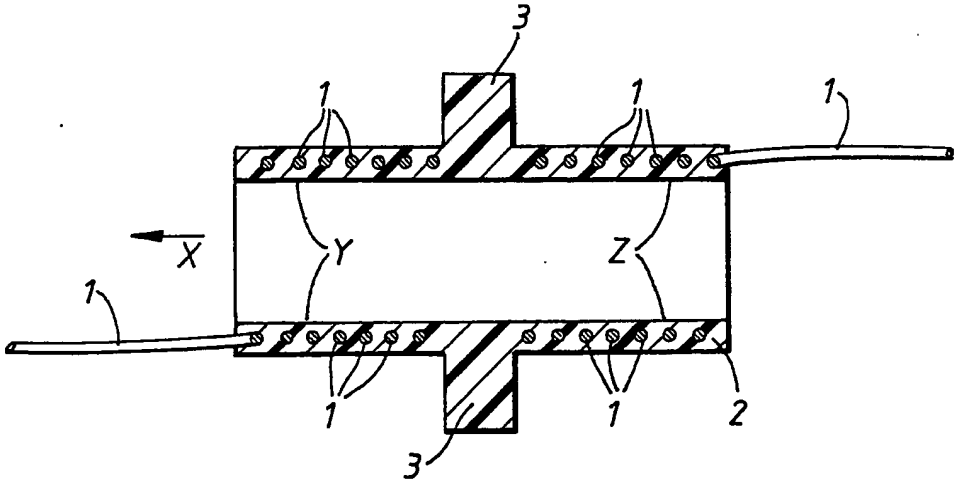

FIG.2.

2189110

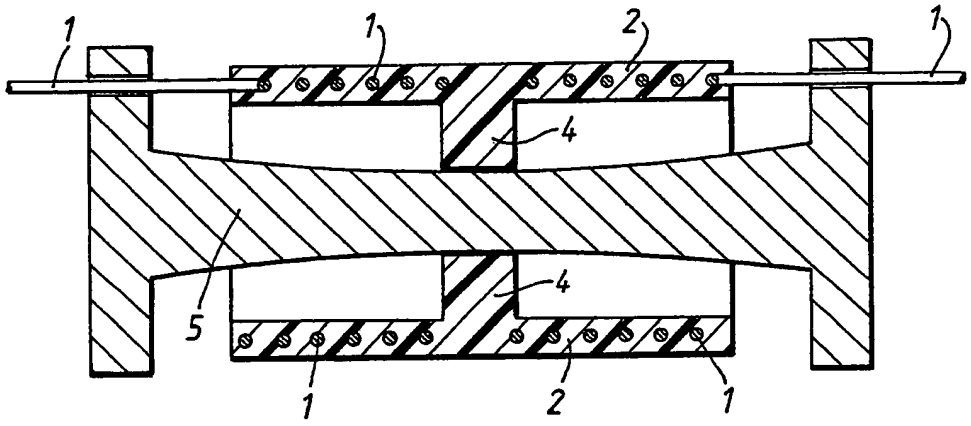

FIG.3.

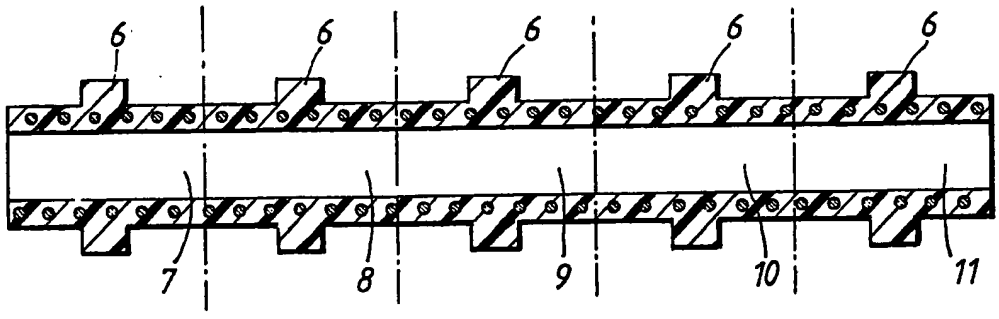

FIG.4.

SPECIFICATION

Improvements relating to optical fibre hydrophones

This invention relates to optical fibre hydrophones comprising coiled lengths of optical fibres which may, for example, be embedded within hollow cylindrical supporting structures.

The present invention seeks to reduce the sensitivity of such optical fibre hydrophones to acceleration forces imposed upon them through their supporting structures and thereby reduce the optical phase shift which can arise in the light propagating through the optical fibre of the hydrophone due to the strain induced in the coiled optical fibre by such acceleration forces.

According to the present invention a coiled optical fibre of optical hydrophone means has at least one supporting structure comprising a hollow cylindrical former for supporting the coiled optical fibre and a radial mounting flange or equivalent located centrally relative to the coiled optical fibre for mounting said hydrophone.

In carrying out the present invention the mounting flange may extend radially outwardly or inwardly from the hollow cylindrical supporting former for the coiled optical fibre and may, if desired, be fabricated integrally therewith.

By arranging that the hydrophone is effectively mounted at the centre of the coiled optical fibre it will be appreciated that in response to acceleration forces in the axial direction of the coiled fibre an elongation of the fibre in one half of the coiled optical fibre due to acceleration-induced strain will be balanced by a fibre length contraction in the other half of the coiled fibre due to acceleration-induced compressive strain. Consequently, the overall length of the coiled optical fibre will remain constant.

By way of example the present invention will now be described with reference to the accompanying drawings which depict various forms of supporting structure for coiled optical fibre hydrophones.

Referring to Figures 1 and 2, these show perspective and axial cross-sectional views of a coiled optical fibre hydrophone. A length of coiled optical fibre 1 is embedded in hollow cylindrical supporting former 2 of an organic polymer for example.

For hydrophone mounting purposes an outwardly extending radial flange 3 is provided and may be formed integrally with the hollow coil supporting former 2. As can be seen, the flange 3 is located centrally relative to the coiled optical fibre 1. As a consequence, when the hydrophone which will be mounted for operation by means of the flange 3 is subject to acceleration forces in the direction, X, say, then the foremost half, Y, of the coil 1 will be subject to compressive stress which will effectively reduce the length of the coiled fibre whereas the rearmost half, Z, of the coiled optical fibre will be subjected to tensile stress which will elongate the coiled fibre. Overall, the length of coiled fibre 1 will remain constant, thereby avoiding an overall change in phase shift of light propagating therethrough. Similarly, pressure changes causing variations in refractive index of the core region of the coiled optical fibre will likewise be balanced out in the two halves of the coiled optical fibre.

Figure 3 shows an alternative support arrangement for the coiled hydrophone. In this embodiment the hollow cylindrical former 2 is provided with an inwardly extending radial mounting flange 4 to which a support bobbin 5 is secured. Once again it will be appreciated that when the hydrophone is subjected to acceleration forces in the general axial direction thereof the consequential contraction in length of one half of the coiled fibre 1 will be balanced by the elongation in length of the other half of the coiled fibre hydrophone. Pressure changes producing changes in the refractive index of the fibre will also be balanced out in the coil halves.

It may here be mentioned that for the avoidance of localised stress concentration points in the coiled optical fibre at positions adjacent the mounting flange 3 or 4 the density of turns of the coiled optical fibre may, if desired, be reduced in the region of the mounting flange 3 or 4.

For optical fibre sensing coils of greater length a plurality of mounting flanges 6 may be located at positions along its length as shown in Figure 4. In this arrangement the hydrophone is composed of a series of balanced coiled sensors 7 to 11 with conceptual but not actual joining points represented by the dotted line shown in the drawing.

Alternatively, of course, the balanced hydrophone could consist of two separately constructed hydrophones fastened symmetrically to the flange with either their fibres spliced together to form an effectively-balanced single hydrophone, or, less advantageously, the optically processed signals from each hydrophone being subtracted after conversion to electrical signals for the purpose of acceleration balancing.

CLAIMS

1. An optical fibre hydrophone comprising a coiled optical fibre and at least one supporting structure therefor, said supporting structure comprising a cylindrical former for supporting the coiled optical fibre and a radial mounting flange or equivalent located centrally relative to the coiled optical fibre for mounting the hydrophone.

2. An optical fibre hydrophone as claimed in claim 1, in which the mounting flange extends radially outwardly from the supporting cylindrical former.

3. An optical fibre hydrophone as claimed in claim 1, in which the mounting flange extends inwardly from the cylindrical former.

4. An optical fibre hydrophone substantially as hereinbefore described and as illustrated in Figure 1 of the accompanying drawings.

5. An optical fibre hydrophone substantially as hereinbefore described and as illustrated in Figure 2 of the accompanying drawings.

The drawing(s) originally filed was (were) informal and the print here reproduced is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1982.

6. An optical fibre hydrophone substantially as hereinbefore described and as illustrated in Figure 3 of the accompanying drawings.

Printed in the United Kingdom for Her Majesty's Stationery Office by the Tweeddale Press Group, 8991685, 10/87 18996. Published at the Patent Office, 25 Southampton Buildings, London WC2A 1AY, from which copies may be obtained.